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# Separator Panels for Dual Purpose Fish/Prawn Trawls

R D Galbraith and
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## Introduction

Underwater observation shows that the capture of fish by trawls is not only a sieving process. Fish are herded for a time and are eventually captured when they become fatigued and enter the mouth of the net (Main and Sangster, 1981). The different species of fish react in characteristic ways when entering the mouth of a bottom trawl. When cod, skate, angler, plaice, lemon sole, dab and shellfish tire they enter the net close to the ground-rope. When haddock tire they rise high ahead of the ground-rig before turning back into the net. Whiting rise higher than the ground fish but lower than the haddock (Fig. 1). These differing reactions can be used to separate catches by species into different cod-ends to the potential advantage of the fishermen. The escape of juvenile fish may also be enhanced by diverting them to larger meshed cod-ends with meshes unobstructed by flatfish and Crustacea.

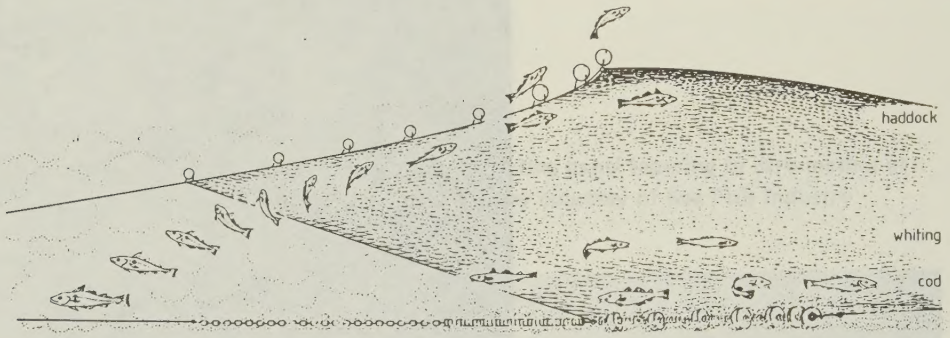



**Figure 1. Position of haddock, whiting, and cod relative to the trawl when tiring and falling back over the ground-rope.**

Experiments have shown that it is possible to separate haddock and whiting from flatfish, cod and *Nephrops* by fitting a horizontal panel of netting inside the trawl. This pamphlet describes the design of proven separator trawls and emphasises the critical factors. It is important, for example, that the separating panel is rigged correctly by being fitted tight and not being allowed to flap (Plate I). It is also very important that the fishing line of the panel is positioned directly above or slightly (less than 1 m) behind the foot-rope. The fishing line of the separating panel must never be rigged to fish ahead of the foot-rope because the haddock, whiting and saithe will be unable to rise quickly enough to enter the top net.

**Plate I. The separating panel fishing line must be directly above the foot-rope and the panel tight and flat.**

## Design and Development

Initial designs of high headline, multi-level trawls for round fish separation were of four panel construction with internal panels of equal width and length to belly and baitings (Main and Sangster, 1982a). Observations using underwater television showed this design worked well with no slack areas of netting evident. Commercial prawn trawls, however, have a much lower headline height and are invariably of two panel construction, as are dual purpose gears designed to take both *Nephrops* and a whitefish bycatch. Trials carried out by the Marine Laboratory, Aberdeen, with a Boris 520 fish/prawn net fitted with a separator panel 100% of belly width (Main and Sangster, 1982b, 1984, 1985a, 1985b), demonstrated that, while *Nephrops* and fish were separated effectively, improvements to the design of the separator panel could eliminate areas of slack netting.

The Sea Fish Industry Authority also conducted trials with this net and carried out 1:10 scale model design tests and full scale fishing experiments with two other nets. A 23 fm (42 m) prawn trawl was fitted with a separator panel 93% of belly width, and a dual purpose net with a panel 88% of belly width. Both separator panels tapered to zero meshes with all upper and lower cod-end meshes attached to baitings and belly respectively (Fig. 2). The authors found that trawls fitted with separator panels showed no significant increase in drag. Marine Laboratory designed nets, however, have upper and lower cod-end lestridges joined conventionally to the main net with the lower section of upper cod-end and upper section of lower cod-end both mended on to the after end of the separator panel (Plate II).

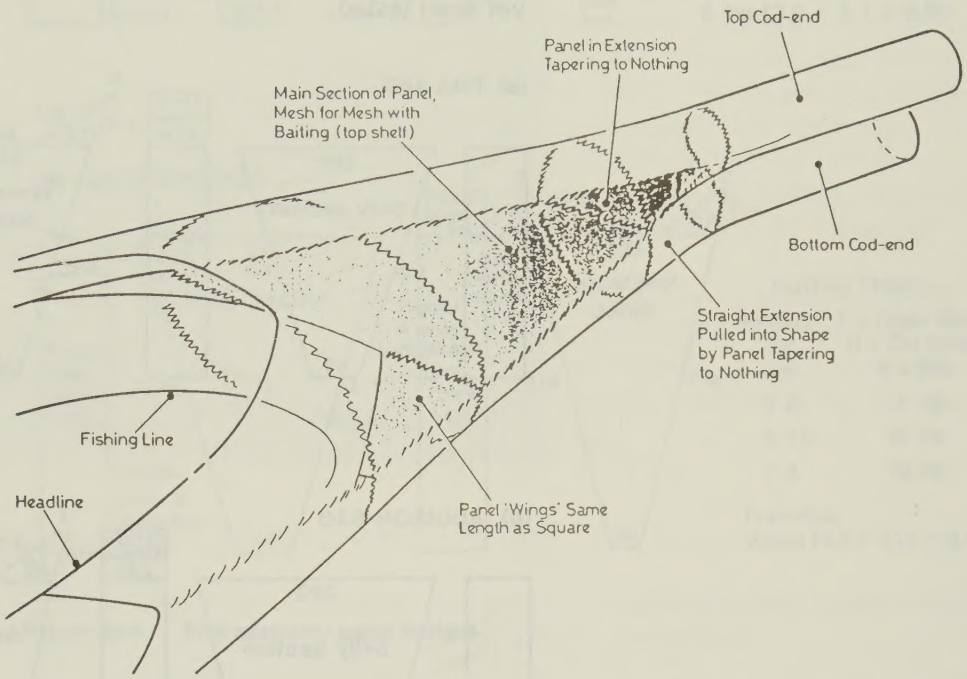
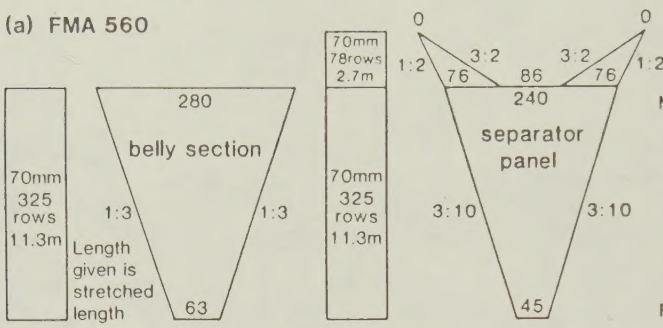

Top Cod-end
Panel in Extension Tapering to Nothing
Main Section of Panel, Mesh for Mesh with Baiting (top shelf)
Bottom Cod-end
Straight Extension Pulled into Shape by Panel Tapering to Nothing
Fishing Line
Headline
Panel 'Wings' Same Length as Square

**Figure 2. The Sea Fish Industry Authority separating panel tapering to zero meshes at the join to the cod-end. (Reproduced by courtesy of Sea Fish Industry Authority).**

**Plate II. The Marine Laboratory design of the panel, having the upper and lower cod-end selvedges joined to the main net selvedge.**

Subsequent diving observations on FRV *Goldseeker* (110 hp) using the FMA 560 net (Fig. 3a) found that a panel 86% of belly width gave satisfactory results with a moderate headline, but using the higher headline Addison 640 (Fig. 3b) on MFV *Aries* (250 hp) an even smaller panel/belly ratio, ie 75%, was required to give optimum results. Thus for high headline, dual purpose trawls, a separator panel can be constructed with as little as 75% of fore belly width (37.5% of fishing circle) tapering to 50% of aft belly width. The 50% value makes it easier to join upper and lower cod-end sections in common to meshes at the aft end of the separator in a 2:1 ratio. Examples of panels designed for Seaway, Cosalt and Jackson 200–250 hp dual purpose nets are also shown (Figs. 3c, 3d and 3e) but at the time of writing have not yet been tested.

(a) FMA 560

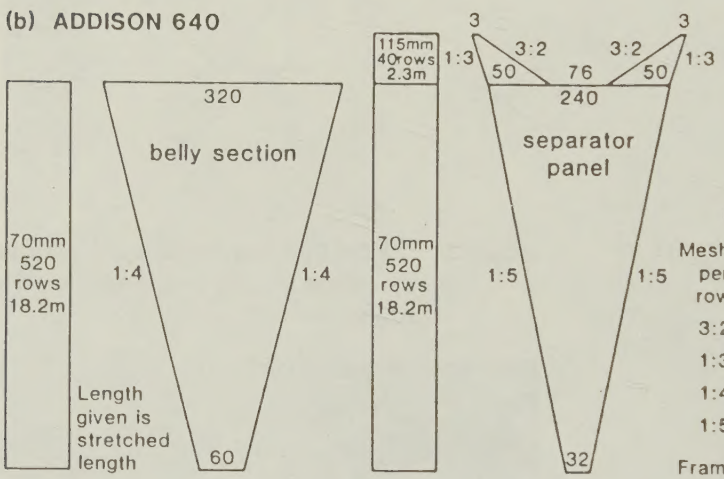



Cutting Rates:

| Meshes per row | T = Clean Mesh N = Cut Mesh B = Bar |
|---|---|
| 3:2 | 1T 1B |
| 1:2 | AB |
| 1:3 | 1N 4B |
| 3:10 | 1N 3B |

Frameline: 10.8m (4.1 + 2.6 + 4.1)

(b) ADDISON 640

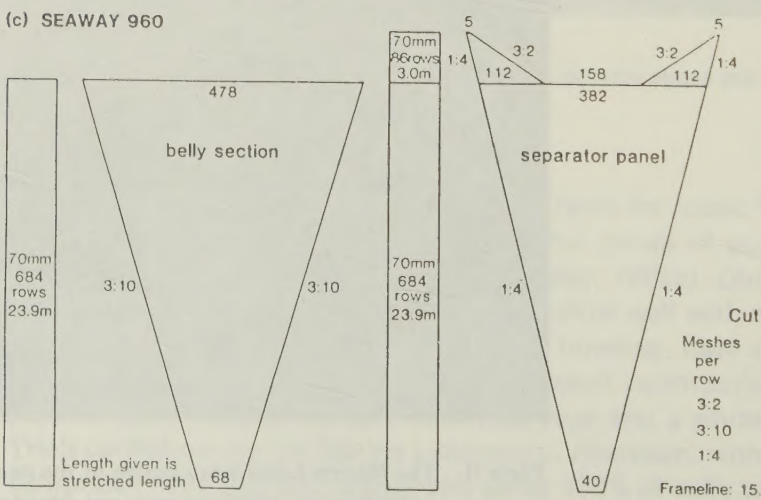



Cutting Rates

| Meshes per row | T = Clean Mesh N = Cut Mesh B = Bar |
|---|---|
| 3:2 | 1T 1B |
| 1:3 | 1N 4B |
| 1:4 | 1N 2B |
| 1:5 | 3N 4B |

Frameline: 10.9m (4 + 2.9 + 4)

(c) SEAWAY 960




Cutting Rates:

| Meshes per row | T = Clean Mesh N = Cut Mesh B = Bar |
|---|---|
| 3:2 | 1T 1B |
| 3:10 | 1N 3B |
| 1:4 | 1N 2B |

Frameline: 15.85m (5.18 + 5.49 + 5.18)

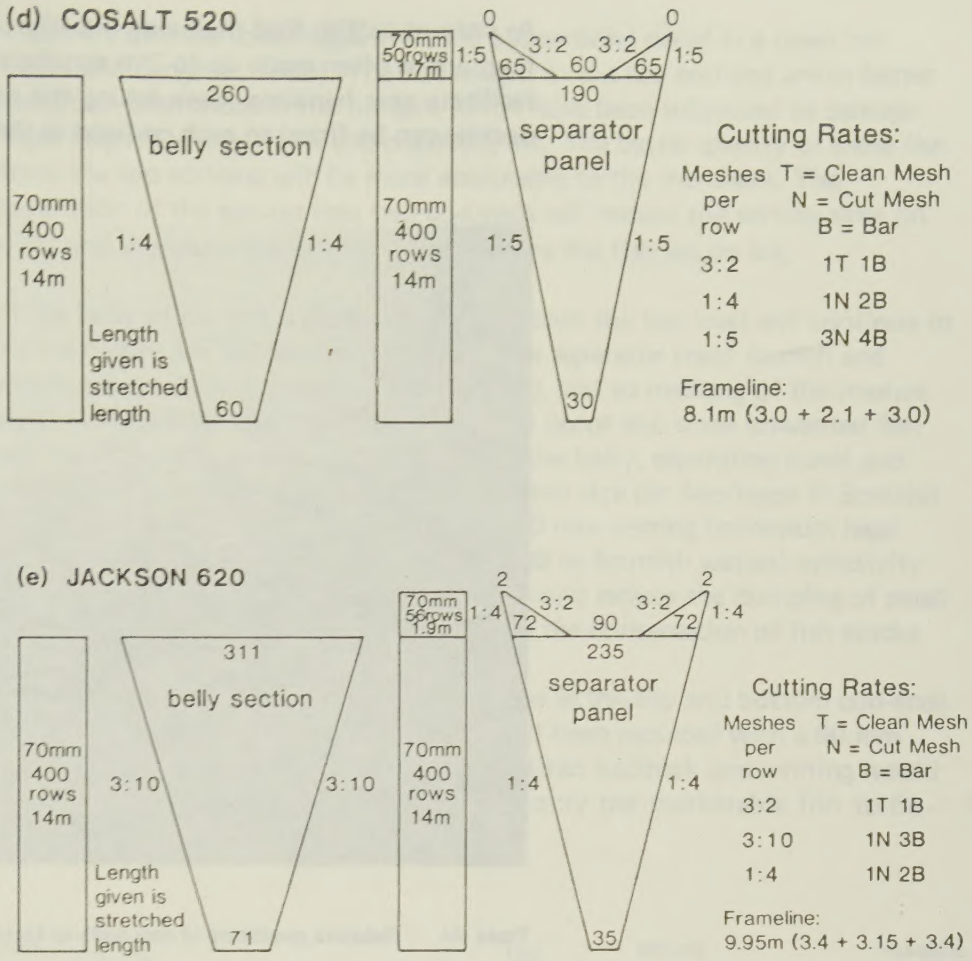



**Figure 3a-e. Five separator panel designs.**

## Net Construction and Modification

Whatever the panel width or cutting rates chosen it is absolutely essential that the length of the panel section is equal to that of the belly section to ensure that the fore end of the separator panel is positioned directly above the fishing line. Upper, lower and separator panels are laced together length for length to form a common lestridge down each side of the net. Provided that the same mesh size and number of rows are used in all three sections there is usually no problem.

Instances have occurred, however, particularly when existing nets are modified, of substantial differences in length between belly and separator panel due to differences in actual, as opposed to nominal, mesh size. Before drawing up specifications to fit an internal panel to a net that has already been used it is advisable to check overall stretched belly length.

As already stated, Marine Laboratory designed nets have upper and lower cod-ends joined lestridge to lestridge (Plate II). This means that the upper half of the top cod-end and lower half of the bottom cod-end can be joined mesh for mesh with baitings and belly respectively. As the after end of the separator panel reduces to significantly fewer meshes than the belly or baitings, the meshes in the lower half of the top cod-end and upper half of the bottom cod-end are taken together and attached to the separator panel using an appropriate joining ratio. When assembled this arrangement gives the appearance of being somewhat restrictive in terms of width but has worked well in practice.

As only roundfish find their way into the upper cod-end it has a tendency to float and is often made up to 2 m shorter than the lower cod-end to facilitate gear handling when taking the catch on board (Plate III). Lazy deckies can be fitted to each cod-end in the usual manner.

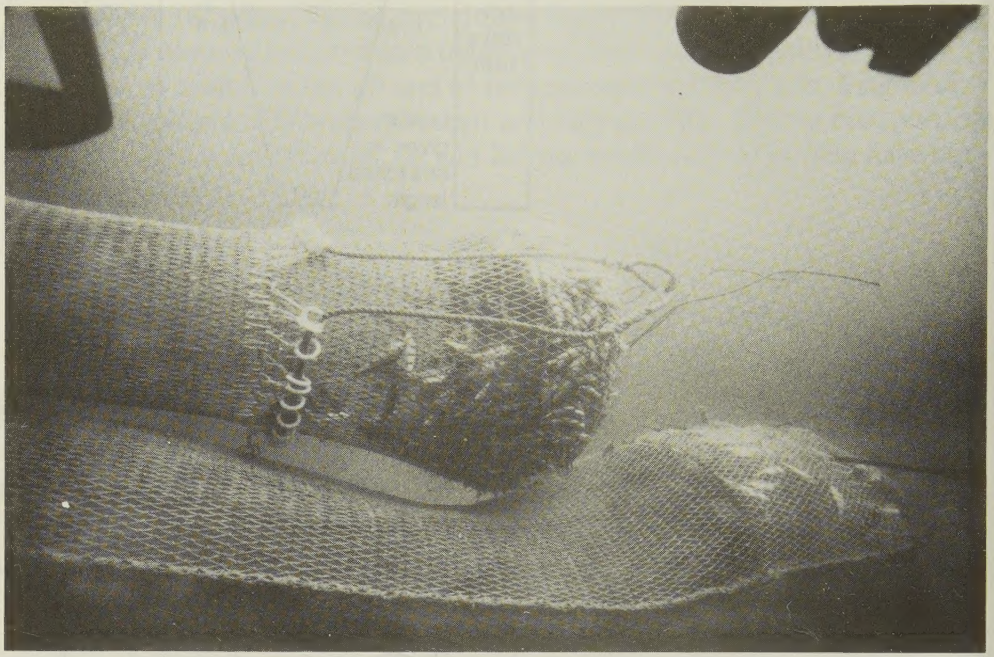


**Plate III. Relative positions of cod-ends to facilitate handling at the surface.**

## Adjustments During Fishing Operations

Strops approximately 1.5 m long should be fitted between the foot-rope and the fishing line of the panel at either end of the bosom (Fig. 4). These strops are for fine tuning of the height of the panel above the ground-rope. If, for example, haddock and whiting are entering the lower net in too great numbers, the strops should be shortened by approximately 15 cm (6 in) on each haul until the desired separation is obtained. It has been suggested that the foot-rope will lift when the fishing line of the panel is tied down but this has not been observed in any of our experiments. Chain can be added to achieve good ground contact.

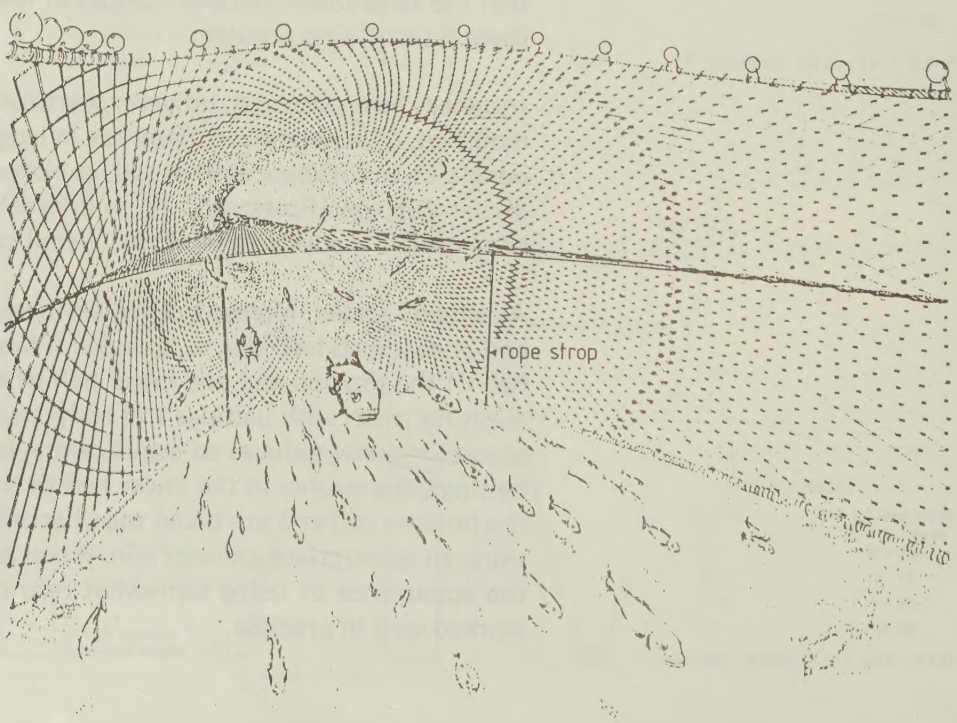



**Figure 4. General view of net mouth showing horizontal separating panel.**

## Discussion

There are definite advantages in fitting a separating panel in a trawl net (Main and Sangster, 1986). The fish caught in the top cod-end are in better condition than those in the bottom which have been subjected to damage from dogfish, skate, shells and crustacea etc. The better quality of these fish from the top cod-end will be more acceptable to the merchant. The separation of the species into two cod-ends will reduce the sorting time on deck and therefore the length of time before the fish are on ice.

If the belly of the net is damaged or badly torn the top level will continue to fish as before for haddock and whiting. In a separator trawl flatfish and *Nephrops* are caught in the bottom cod-end, and so masking of the meshes by these species in the top cod-end will not occur and small unwanted fish will be allowed to escape. By constructing the belly, separating panel and cod-end of 70 mm mesh (minimum legal mesh size for *Nephrops* in Scottish waters) and the top sheet and cod-end of 90 mm netting (minimum legal mesh size for finfish as from 1 January 1989 in Scottish waters) selectivity for finfish will be further improved. This would reduce the dumping of small unwanted fish at sea and therefore improve the conservation of fish stocks.

The histograms in Figure 5 show the catches in the top and bottom cod-ends using a 70 mm mesh. If the top cod-end had been replaced with a 90 mm mesh, then most of these unwanted, undersized haddock and whiting would have escaped to survive and grow, leaving only the marketable fish to be taken on board.

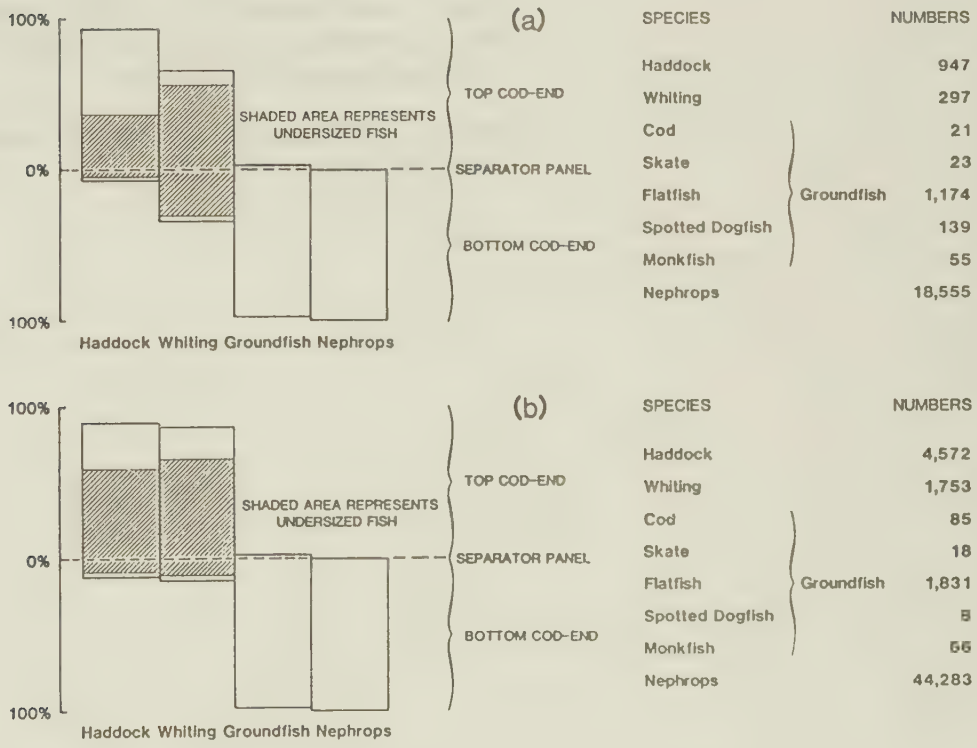



**Figure 5. Histograms showing separation of catches between the top and bottom cod-ends.**
**(a) Small Isles fishery (results from 13 daylight hauls)**
**(b) South Deeps fishery (results from nine day light hauls)**

With an additional internal panel and cod-end there will obviously be a gear cost increase in terms of both materials and labour. It is estimated that a net so constructed would cost between one quarter and one third more than a conventional trawl.

**Summary** Trials have demonstrated that haddock and whiting can be separated from *Nephrops* and other ground fish by fitting an internal horizontal separator panel in a bottom trawl. The design of panels for dual purpose fish/prawn trawls is discussed and examples are presented for some commonly used Scottish commercial nets.

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